Vertical Resolution Enhancement of Geophysical Logs in Gas Hydrate Bearing Sands of the Nankai Trough

Doug Murray[1]; Steve Alderman[2]; Takatoshi Namikawa[3]; Masafumi Fukuhara[1]

[1] Schlumberger K.K.; [2] Schlumberger DCS; [3] JOGMEC

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Gas Hydrates are white crystalline solids composed of gas (usually methane) and water. The gas molecules are densely packed and contain large amounts of energy. Hydrates are commonly found in deep offshore; shallow seabed sediments and below permanent frost in arctic areas where the environmental conditions of low temperature and high pressure are conducive to hydrate formation.

Many techniques have been developed in gas hydrate reservoir formation evaluation to describe the amount of hydrate present in a rock. Mostly, these techniques depend on the measured responses of the resistivity, nuclear, acoustic and magnetic resonance geophysical logs. These techniques have proven robust and are dependent on the underlying resolution of the measurement. Depending on the measurement vintage and type, the vertical resolution of geophysical logs can vary from ˜10mm to ˜3 meters. This is not a significant issue when the reservoir bed thickness is greater than 3 meters but can play an important role in thinly laminated reservoirs like those found in pelagic shallow seabed sediments.

This paper presents an approach to resolve some of these vertical resolution issues. Its fundamental assumption is that the highest resolution measurement can be used to model the thin bed response of the lower resolution measurements. Two types of datasets are presented; i.) wireline and ii.) logging while drilling (LWD). For the wireline dataset the highest resolution device is the Fullbore Formation Micro-Imager (FMI∗) with a vertical resolution of ˜10mm while the lowest resolution tool is the sonic at ˜60cm. For the LWD the highest resolution device is the Resistivity at Bit (RAB∗) at ˜5cm, and the lowest resolution tool is the magnetic resonance at ˜100cm.

∗Mark of Schlumberger